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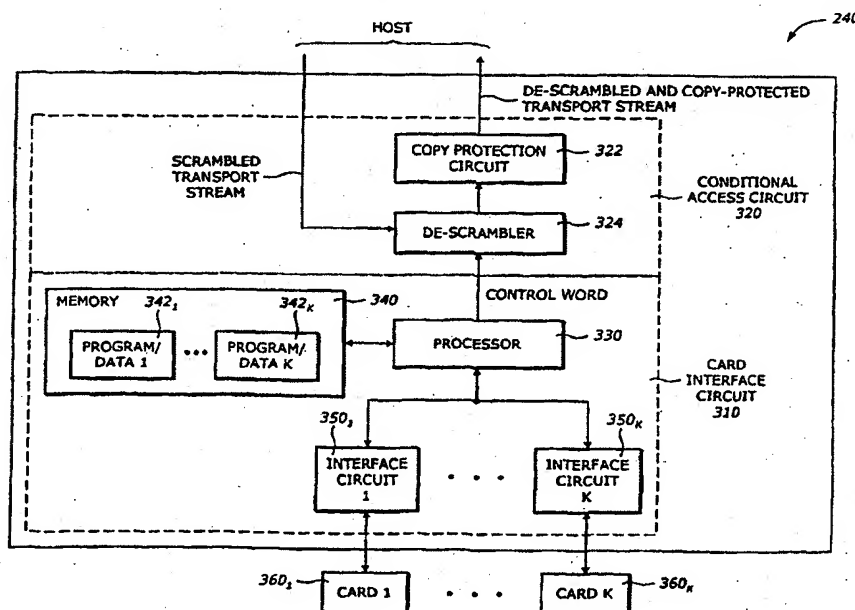International Bureau

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(71) Applicant: SONY ELECTRONICS, INC. [US/US]; 1 Sony Drive, Park Ridge, NJ 07656 (US).

(72) Inventor: CANDELORE, Brant, L.; 10124 Quail Glen Way, Escondido, CA 92029-6502 (US).

(74) Agents: SOBRINO, Maria, E. et al.; Blakely, Sokoloff, Taylor & Zafman, 7th Floor, 12400 Wilshire Boulevard, Los Angeles, CA 90025-1026 (US).

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(54) Title: SYSTEM FOR INTERFACING MULTIPLE CONDITIONAL ACCESS DEVICES

(57) Abstract

The present invention is a method and apparatus for interfacing a plurality of cards (360, ..., 360k) to a device (240) having a conditional access (CA) circuit (320). A plurality of interface circuits (350, ..., 350k) provides access to the plurality of cards (360,...,360k). A processor (330) is coupled to the plurality of interface circuits (350, ..., 350k) to communicate with one of the plurality of cards based on service information (SI) in a stream transmitted.

SYSTEM FOR INTERFACING MULTIPLE CONDITIONAL ACCESS DEVICES

BACKGROUND

1. Field of the Invention

The present invention is related to conditional access modules. In particular, the present invention is related to interfacing multiple conditional access modules.

2. Description of Related Art

Modern set-top boxes generally have a receiver to receive program data, or content, from a service provider and generate multiple transport streams. The content is normally scrambled before being transmitted to the receiver. The scrambled content is then de-scrambled by a conditional access (CA) device. In the U.S., the National Renewable Security System (NRSS) defines two types of CA devices or modules: an NRSS part A module supporting a smart card form factor, and an NRSS part B module supporting a PCMCIA form factor. In Europe, Digital Video Broadcasting (DVB) defines one type of CA device called Common Interface supporting a PCMCIA form factor.

The unscrambled content is then transferred to a digital device such as a display device (e.g., digital television) for program viewing or a recording device (e.g., digital video cassette recorder) for program recording. In many scenarios, multiple digital devices are connected to the conditional access device for simultaneous activities such as viewing while recording or viewing at different display locations.

Terrestrial broadcasters may each use different CA providers to perform access control on channels within their individual broadcast. Typically, a viewer may receive several, e.g., six or more, terrestrial channels. If each broadcaster uses a different CA vendor, then the number of CA slots to support these CA

modules or devices may be large. Also, in the U.S., there are currently three Direct Broadcast Satellite (DBS) systems, DirecTV, Echostar and PrimeStar. Each uses a different conditional access provider. DBS functionality is being built into TV's which will also receive signals terrestrially. TV and set tops are also being built to descramble cable signals. Consequently, a television or an integrated set-top box may be required to support several CA devices, cards, or modules at the same time. This may result in complexity in hardware for the host or set-top box. Furthermore, a viewer may have to switch CA modules manually causing inconvenience.

Therefore, there is a need to have an efficient and flexible technique to interface to multiple CA providers.

SUMMARY

The present invention is a method and apparatus for interfacing a plurality of cards to a device having a conditional access (CA) circuit. A plurality of interface circuits provides access to the plurality of cards. A processor is coupled to the plurality of interface circuits to communicate with one of the plurality of cards based on service information (SI) in a stream transmitted.

In one embodiment, the plurality of cards are ISO7816 or National Renewable Security Standard (NRSS) type A cards which are interfaced to a television or set top device through a single NRSS type B or Digital Video Broadcasting (DVB) Common Interface Slot. The television or set top device needs only to deal with a single NRSS type B module. A card is selected from a plurality of cards on the NRSS-B module based on the SI in a stream transmitted.

BRIEF DESCRIPTION OF THE DRAWINGS

The features and advantages of the present invention will become apparent from the following detailed description of the present invention in which:

Figure 1 is a diagram illustrating a system in which one embodiment of the invention can be practiced.

Figure 2 is a diagram illustrating a digital receiver and a decoder according to one embodiment of the invention.

Figure 3 is a diagram illustrating a conditional access device according to one embodiment of the invention.

Figure 4 is a diagram illustrating an interface system according to one embodiment of the invention.

Figure 5 is a flowchart illustrating a process to interface to the plurality of cards according to one embodiment of the invention.

DESCRIPTION

The present invention is a method and apparatus to interface a plurality of conditional access (CA) cards. A plurality of interface circuits provides access to the plurality of smart cards. A processor is coupled to the plurality of interface circuits to communicate with one of the plurality of cards based on service information (SI) in a stream transmitted through the CA circuit. The processor extracts a code from the SI identifying a channel selected by a user.

In one embodiment, the plurality of cards are ISO7816 or National Renewable Security Standard (NRSS) type A cards which are interfaced to a television or set top device through a single NRSS type B or Digital Video Broadcasting (DVB) Common Interface Slot. The television or set top device

needs only to deal with a single NRSS type B module. A card is selected from a plurality of cards on the NRSS-B module based on the SI in a stream transmitted.

In another embodiment, the cards nay be NRSS type A or type B modules. The NRSS modules can be selected individually or connected in a daisy chain manner to carry the transport stream.

By providing access to multiple cards, the number of card slots in the integrated set-top box or CA device can be minimized. In addition, the use of a processor to switch the cards is flexible and convenient to the user.

In the following description, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be apparent, however, to one of ordinary skill in the art that the present invention may be practiced without these specific details. In other instances, well-known architectures, steps, and techniques have not been shown where unnecessary for an understanding of the present invention. For example, specific details are not provided as to whether the method is implemented in a station as a software routine, hardware circuit, firmware, or a combination thereof. The term "stream" refers to a transport stream which is typically in a digital form.

Figure 1 is a diagram illustrating a system 100 in which one embodiment of the invention can be practiced. The system 100 includes a program data receiver 110, a transmission medium 120, an audio system 130, a digital video recorder or player 140, a disk recording unit 150, a display 160, a control unit 170, and a network CA unit 180. Any of the audio system 130, the digital video recorder or player 140, the disk recording unit 150, the display 160 and the control unit 170, or any combination thereof may be referred to as a digital device.

The program data receiver 110 includes a digital receiver 112 and a decoder 114. The digital receiver 112 receives digital bitstream or data including program data from one or more service providers. Such service or

4

content providers may include terrestrial broadcasters, cable operators, direct broadcast satellite (DBS) companies, companies providing content for download via the Internet, book publisher, software companies distributing software products, or any similar content and/or service provider. The program data may include system information, entitlement control messages, entitlement management messages, content, and other data. System information may include information on program names, time of broadcast, source, method of retrieving and decoding, copy management commands that provide digital receivers and other devices that control how, when, and what program data may be replayed, retransmitted, copied, and/or recorded. These copy management commands may also be transmitted along with entitlement control messages (ECM), which are generally used by the conditional access unit to regulate access to a particular channel or service. Entitlement management messages (EMM) may be used to deliver privileges such as rights and de-scrambling keys. As known, a decryption or de-scrambling key is generally a code that is required to restore the scrambled data, and may be a function of the rights granted. Finally, content in the program data may include audio and video data, which may be in s scrambled or encrypted or clear format. In one embodiment, the program data receiver 110 is a television set where the digital receiver 112 is a set-top box integrated therein, and the decoder 114 is a Motion Picture Experts Group (MPEG) decoder.

The transmission medium 120 operates to transmit control information and data including program data between the program data receiver 110 and other components in the system 100. The transmission medium 120 may include air, fiber optics, electronic and magnetic media, computer network connection, telephone connection, and any other communication media.

The audio system 130 is coupled to the transmission medium 130 to provide audio services. The audio system 130 may include speakers, an audio player/recorder such as a compact disk player, or other magneto-optical disc

5

that may be used to play and/or record audio data. The digital video recorder/player 140 is coupled to the transmission medium 120 to provide video services. The digital video recorder/player 140 may be used to record analog or digital video, audio, and other data transmissions. In one embodiment, the digital video recorder/player 140 may be used to replay or record the program data received by the program data receiver 110 and transmitted over the transmission medium 120.

The disk recording unit 150 may also be coupled to the program data receiver 110 and other components via the transmission medium 120. The disk recording unit 150 may be a personal computer system, a stand-alone hard disk recording unit, or other disk recording device capable of recording analog or digital audio, video and data transmissions, including the program data received and transmitted by the program data receiver 110.

The display 160 may include a television display, a monitor display or other devices capable of processing and displaying video signals. In one embodiment, the display 160 is a digital television set. The control unit 170 may also be coupled to the transmission medium 120 to coordinate and control the operation of some or each of the components on the system 100, as well as other devices remotely coupled thereto.

The network conditional access (CA) unit 180 may also be coupled to the transmission medium 120. The network CA unit 180 operates to re-scramble program data with content in clear format such that the system 100 supports the simultaneous transmission of program data in clear and scrambled format. The network CA unit 180 may be a CA device that operates as a second CA device in a system embodiment where the program data receiver 110 operates as a master CA device.

Figure 2 is a diagram illustrating a digital receiver 112 according to one embodiment of the invention. The digital receiver 112 includes a central

6

processing unit (CPU) 210, a tuner 220, a demodulator 230, a conditional access (CA) unit 240, and a demultiplexer 250.

The control processing unit 210 performs control functions for the tuner 220, the CA unit 240 and the demultiplexer 250. The CPU 210 may determine the frequency in which a channel is broadcast or otherwise transmitted. The CPU 210 may support a graphical user interface (GUI), such as electronic programming guide (EPG) to allow a user to navigate through various channels and program options to select a desired channel or program for viewing, listening, recording and the like.

The tuner 220 selects a frequency of the signal received by the program data receiver 110 (in Figure 1) under the control of the CPU 210. The tuner 220 processes, amplifies, digitizes, and generates a bitstream to the demodulator 230.

The demodulator 230 demodulates the bitstream received from the tuner 220 to provide the program data as originally transmitted. The type of demodulation performed by the demodulator 230 depends on the type of transmission as well as the modulation process used in the transmission process. Examples of the demodulation includes quadrature amplitude modulation (QAM) demodulation, quadrature phase shift key (QPSK) demodulation, and vestigial side band (VSB) demodulation. In addition, the demodulator 230 may perform error correction on the received bitstream.

The conditional access unit 240 may be integral or external to the digital receiver 112. The CA unit 240 provides conditional access to the program data as provided by the demodulator 230. The program data is typically scrambled using an access key. The CA unit 240 may be used in an external or split mode. In the external mode, the CA unit 240 de-scrambles the program data content and decrypts the keys externally; e.g., as is the case with the National Renewable Security System (NRSS) conditional access modules. In a split conditional access

7

unit, the program data content is de-scrambled within the digital receiver 112, while the key decryption is done externally, e.g., via a smart card.

The demultiplexer 250 receives the de-scrambled or unscrambled content from the CA unit 240. The demultiplexer 250 separates the system information from the content in the program data, and according to one embodiment, parses the program data for packet identifiers that are associated with the system information, audio information, and video information, and then transmits the system information to the control processing unit 210 and the audio and video information to the decoder 114 (in Figure 1).

When the CA device 240 is used externally to the digital receiver 112, the digital receiver 112 is typically referred to as a host. In the following, a host is used to describe a digital receiver or any device or system that can provide a transport stream to the CA device.

Figure 3 is a diagram illustrating a conditional access (CA) device 240 according to one embodiment of the invention. The CA device 240 includes a card interface circuit 310 and a CA circuit 320.

The card interface circuit 310 is coupled to the CA circuit 320 to provide interface between the CA device 240 and a plurality of cards 360_1 to 360_K. The card interface circuit 310 includes a processor 330, a memory 340, and a plurality of interface circuits 350_1 to 350_K. The CA circuit 320 de-scrambles a stream and generates a copy-protected stream to the host. The CA circuit 320 includes a copy protection circuit 322 and a de-scrambler 324.

The de-scrambler 324 receives and de-scrambles a transport stream from the host to generate a de-scrambled stream. The de-scrambler 324 receives the control and a de-scrambling key from the processor 330.

The copy protection circuit 322 receives the de-scrambled stream from the de-scrambler 324 and generates a copy-protected stream to the host. In general,

8

the host then receives a de-scrambled and copy-protected stream from the CA device 240.

The processor 330 provides control and coordination of conditional access operations including communication with the plurality of cards 360_1 to 360_K. The processor 330 extracts a code from the service information (SI) embedded in a stream from one of the cards 360_1 to 360_K. The SI contains a code identifying a channel selected by a user.

The memory 340 is coupled to the processor 330 to provide program and data corresponding to the identified channel. The memory 340 includes program/data 342_1 to 342_K corresponding to the cards 360_1 to 360_K, respectively. The processor 330 uses the extracted code as a pointer to execute the program and use the data from the program/data 342_1 to 342_K.

The interface circuits 350_1 to 350_K provide access to the cards 360_1 to 360_K, respectively. Each of the 350_1 to 350_K operates to conform with the standard of the corresponding card. The card standard may be one of smart, personal computer memory card international association (PCMCIA), personal computer (PC), small PC, miniature, smart media, multimedia, compact flash, National Renewable Security Standard (NRSS) type A and type B card standards. By having a card interface that can operate with a variety of cards, the CA device 240 supports a system that have several CA streams provided by the cards 360_1 to 360_K. In this manner, when the CA device 240 is integrated with the host like in the case of an integrated set-top box and a television set, the channel switching can be done by the processor rather than by manual switching of the CA modules.

Figure 4 is a diagram illustrating an interface system 400 according to one embodiment of the invention. The interface system 400 includes the CA device 240 and a plurality of modules 410_1 to 410_K.

9

The CA device 240 is the same as described in Figure 3. For clarity, only the processor 330 and the interface circuits 350_1, 350_2, . . ., 350_k are shown. The interface circuits 350_1 to 350_k have proper interface to the corresponding modules.

Each of the modules 410_1 to 410_k may be another CA device or module. In one embodiment, the card 410_1 is a smart card or a PCMCIA card. Each of the modules 410_2 to 410_k may be an NRSS type A or type B module. The modules 410_2 to 410_k include de-scrambler 412_2 to 412_k, respectively.

The card 410_1 sends a control word to the processor 330 for writing to the scrambler 324. Each of the modules 410_2 to 410_k de-scrambles the transport stream on its own. In this way, the de-scrambling may be replaced by changing the modules 410_2 to 410_k that are plugged into the CA device 240. The transport stream travels into one of the modules 410_2 to 410_k in use. The modules 410_2 to 410_k may be connected in a daisy chain manner or can be selected individually by the processor 330.

Figure 5 is a flowchart illustrating a process 500 to interface to the plurality of cards according to one embodiment of the invention.

Upon START, the process 500 receives a transport stream corresponding to a content provided by the host or a CA module (Block 510). Then the process 500 extracts a code from the service information (SI) in the transport stream (Block 520). The SI processing is performed in accordance to the relevant standard, e.g., the Digital Video Broadcasting (DVB) standard provided by the European Telecommunications Standard Institute (ETSI) EN 300 468 V1.3.1.

Next, the process 500 executes a program stored in the memory corresponding to the channel identified by the extracted code (Block 530). Then, the process 500 communicates with one of the cards or modules corresponding to the identified channel (Block 540). The process 500 is then terminated.

While this invention has been described with reference to illustrative embodiments, this description is not intended to be construed in a limiting sense. Various modifications of the illustrative embodiments, as well as other embodiments of the invention, which are apparent to persons skilled in the art to which the invention pertains are deemed to lie within the spirit and scope of the invention.

CLAIMS

What is claimed is:

1. An apparatus to interface a plurality of cards (360,...,360k) to a
    device (240) having a conditional access (CA) circuit (320), the
    apparatus comprising:

    a plurality of interface circuits (350,...,350k) coupled to the
    plurality of cards (360,...,360k) to provide access to the plurality of
    cards (360,...,360k); and

    a processor (330) coupled to the plurality of interface circuits
    (350,...,350k) to communicate with one of the plurality of cards
    based on service information (SI) in a stream transmitted through
    the CA circuit (320).

2. The apparatus of Claim 1 wherein the processor (330) extracts a
    code from the SI identifying a channel selected by a user.

3. The apparatus of Claim 2 further comprising a memory (330)
    containing a program (342) servicing the channel identified by the
    extracted code.

4. The apparatus of Claim 3 wherein the conditional access circuit
    (320) corresponds to at least one of National Renewable Security
    Standard (NRSS) type B standard and Digital Video Broadcasting
    (DVB) common interface standard.

5. The apparatus of Claim 4 wherein the plurality of cards
    (360,...,360k) corresponds to at least one of smart, personal
    computer memory card international association (PCMCIA),
    personal computer (PC), small PC, miniature, smart media,

12

multimedia, compact flash, National Renewable Security Standard (NRSS) type A and type B card, and Digital Video Broadcasting (DVB) common interface standards.

6. The apparatus of Claim 5 wherein the CA device (240) is one of National Renewable Security Standard (NRSS) type A and type B modules.

7. The apparatus of Claim 6 wherein at least one of the plurality of cards has a card de-scrambler (412) to de-scramble a transport stream.

8. A method to interface a plurality of cards (360,...,360k) to a device (240) having a conditional access (CA) circuit (320), the method comprising:

providing access to the plurality of cards (360,...,360k) by a plurality of interface circuits (350,...,350k); and

communicating with one of the plurality of external cards based on service information (SI) in a stream transmitted through the CA circuit (320) by a processor (330).

9. The method of Claim 8 further comprising:

extracting a code from the SI identifying a channel selected by a user.

10. The method of Claim 9 wherein the SI corresponds to a digital video broadcasting (DVB) standard.

11. The method of Claim 10 wherein the conditional access circuit (320) corresponds to at least one of National Renewable Security

13

Standard (NRSS) type B standard and Digital Video Broadcasting (DVB) common interface standard.

12. The method of Claim 11 wherein the plurality of cards (360,...,360k) correspond to at least one of smart, personal computer memory card international association (PCMCIA), personal computer (PC), small PC, miniature, smart media, multimedia, compact flash, National Renewable Security Standard (NRSS) type A and type B card, and Digital Video Broadcasting (DVB) common interface standards.

13. The method of Claim 12 wherein the CA device (240) is one of National Renewable Security Standard (NRSS) type A and type B modules.

14. The method of Claim 13 wherein at least one of the plurality of cards has a card de-scrambler (412) to de-scramble a transport stream.

15. A system comprising:

a plurality of cards (360,...,360k) to transport a stream;

a conditional access (CA) device (240) coupled to the plurality of cards (360,...,360k) to provide conditional access to the stream, the CA device (240) having a CA circuit (320); and

a circuit (310) coupled to the plurality of cards (360,...,360k) and the CA circuit (320) to interface the plurality of cards (360,...,360k) to the CA circuit (320), the circuit (310) comprising:

a plurality of interface circuits (350,...,350k) coupled to the plurality of cards (360,...,360k) to provide access to the plurality of cards (360,...,360k), and

14

a processor (330) coupled to the plurality of interface circuits
(350,...,350k) to communicate with one of the plurality of cards
based on service information (SI) in a stream transmitted through
the CA circuit (320).

16. The system of Claim 15 wherein the processor (330) extracts a code
from the SI identifying a channel selected by a user.

17. The system of Claim 16 wherein the circuit (310) further comprises
a memory (340) containing a program (342) servicing the channel
identified by the extracted code..

18. The system of Claim 17 wherein the conditional access circuit (320)
corresponds to at least one of National Renewable Security
Standard (NRSS) type B standard and Digital Video Broadcasting
(DVB) common interface standard.

19. The system of Claim 18 wherein the plurality of cards corresponds
to at least one of smart, personal computer memory card
(360,...,360k) international association (PCMCIA), personal
computer (PC), small PC, miniature, smart media, multimedia,
compact flash, National Renewable Security Standard (NRSS) type
A and type B card, and Digital Video Broadcasting (DVB) common
interface standards.

20. The system of Claim 19 wherein the CA device (240) is one of
National Renewable Security Standard (NRSS) type A and type B
modules.

21. The system of Claim 20 wherein at least one of the plurality of
cards has a card de-scrambler (412) to de-scramble a transport
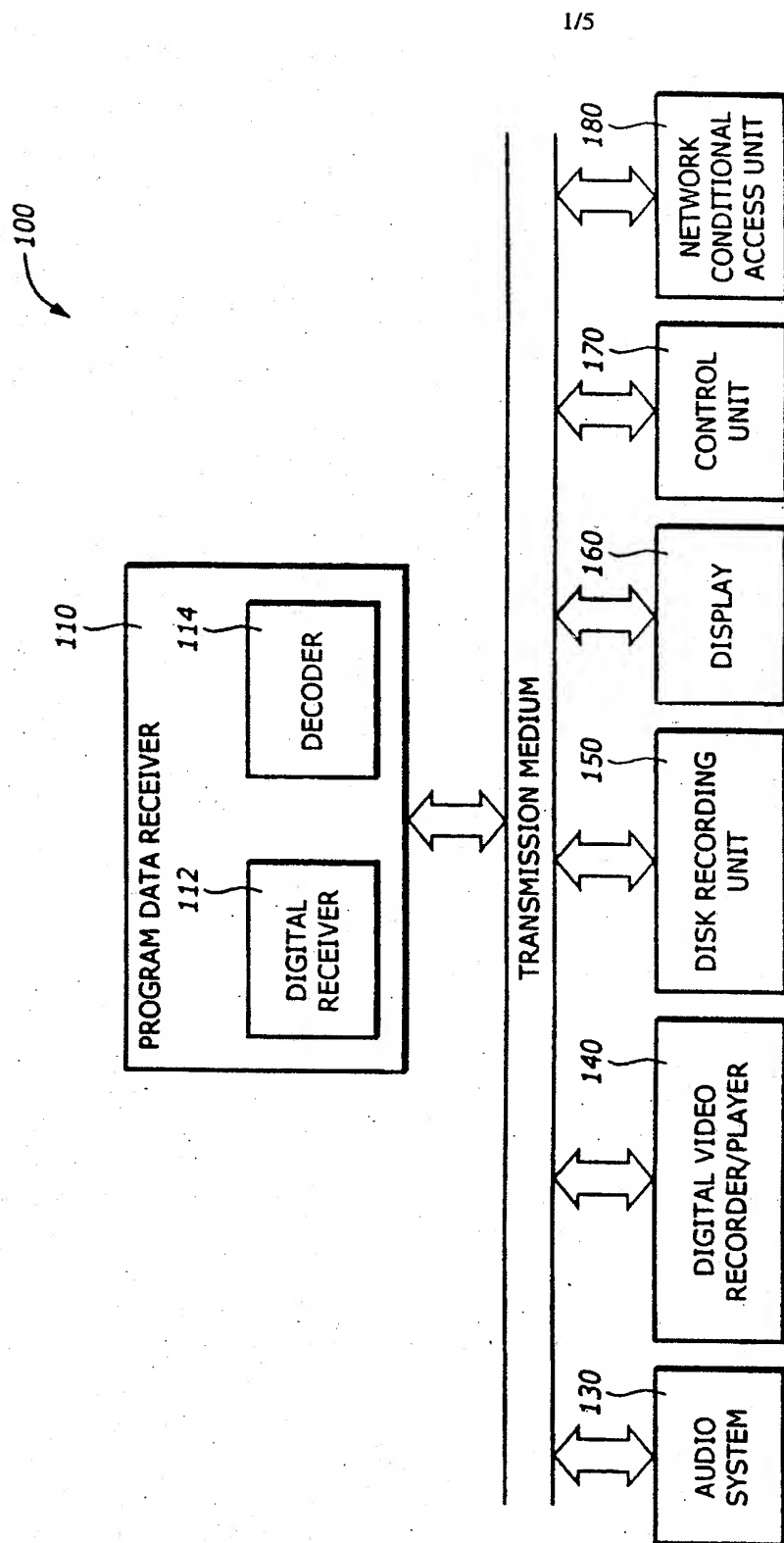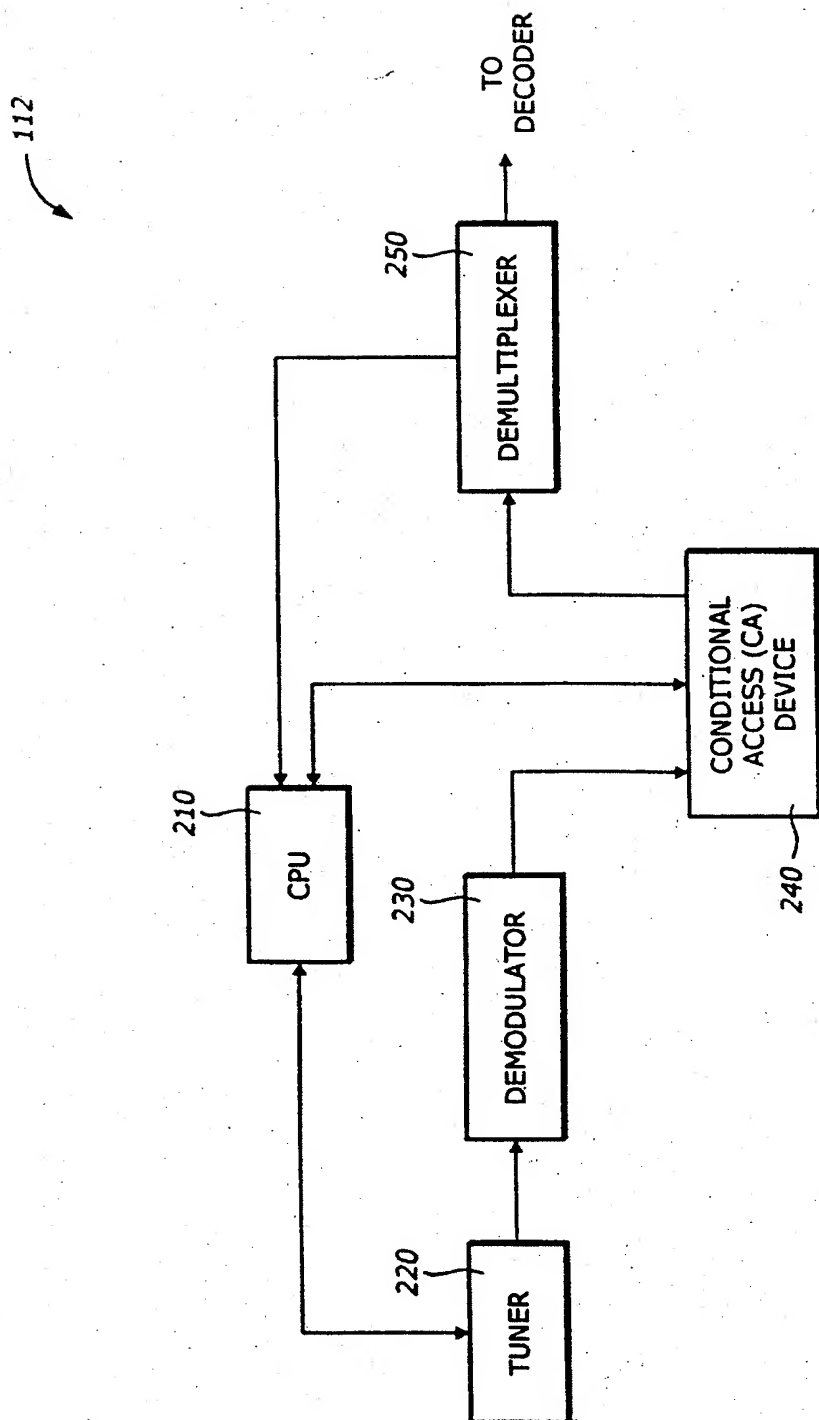stream.

15

FIG. 1

FIG. 2

FIG. 3

FIG. 4

500

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              ┌───────────┐
              │   START   │
              └─────┬─────┘
                    │
  510               ▼
        ┌──────────────────────────┐
        │  RECEIVE TRANSPORT STREAM │
        └─────────────┬────────────┘
                      │
  520                 ▼
        ┌──────────────────────────┐
        │     EXTRACT A CODE FROM   │
        │  SERVICE INFORMATION (SI) │
        │    IN THE TRANSPORT STREAM│
        └─────────────┬────────────┘
                      │
  530                 ▼
    ┌──────────────────────────────────────┐
    │    EXECUTE PROGRAM CORRESPONDING      │
    │ TO THE CHANNEL IDENTIFIED BY THE CODE │
    └─────────────────┬────────────────────┘
                      │
  540                 ▼
        ┌──────────────────────────┐
        │  COMMUNICATE WITH ONE OF  │
        │  THE CARDS CORRESPONDING  │
        │  TO THE IDENTIFIED CHANNEL│
        └─────────────┬────────────┘
                      │
                      ▼
              ┌───────────┐
              │    END    │
              └───────────┘
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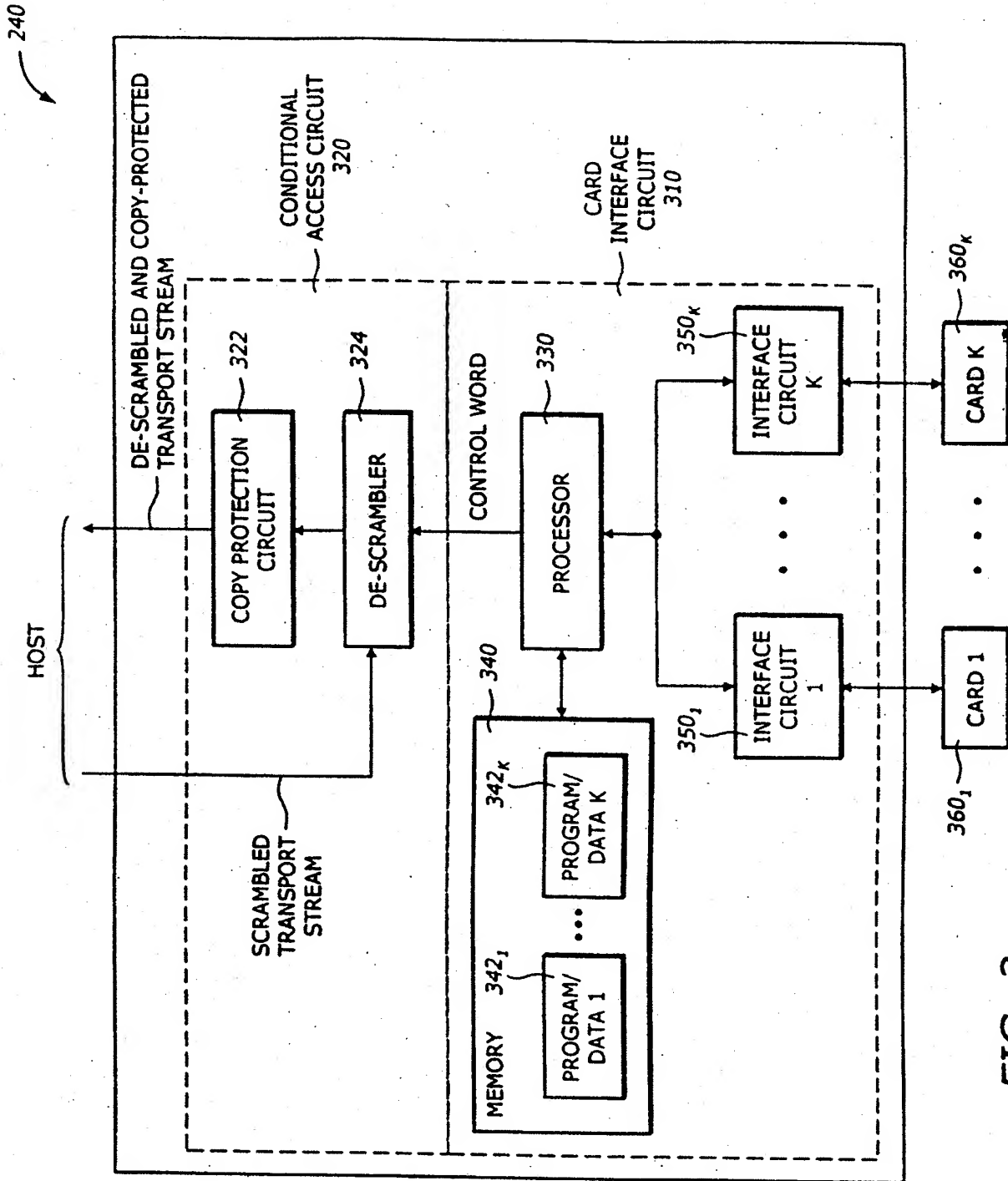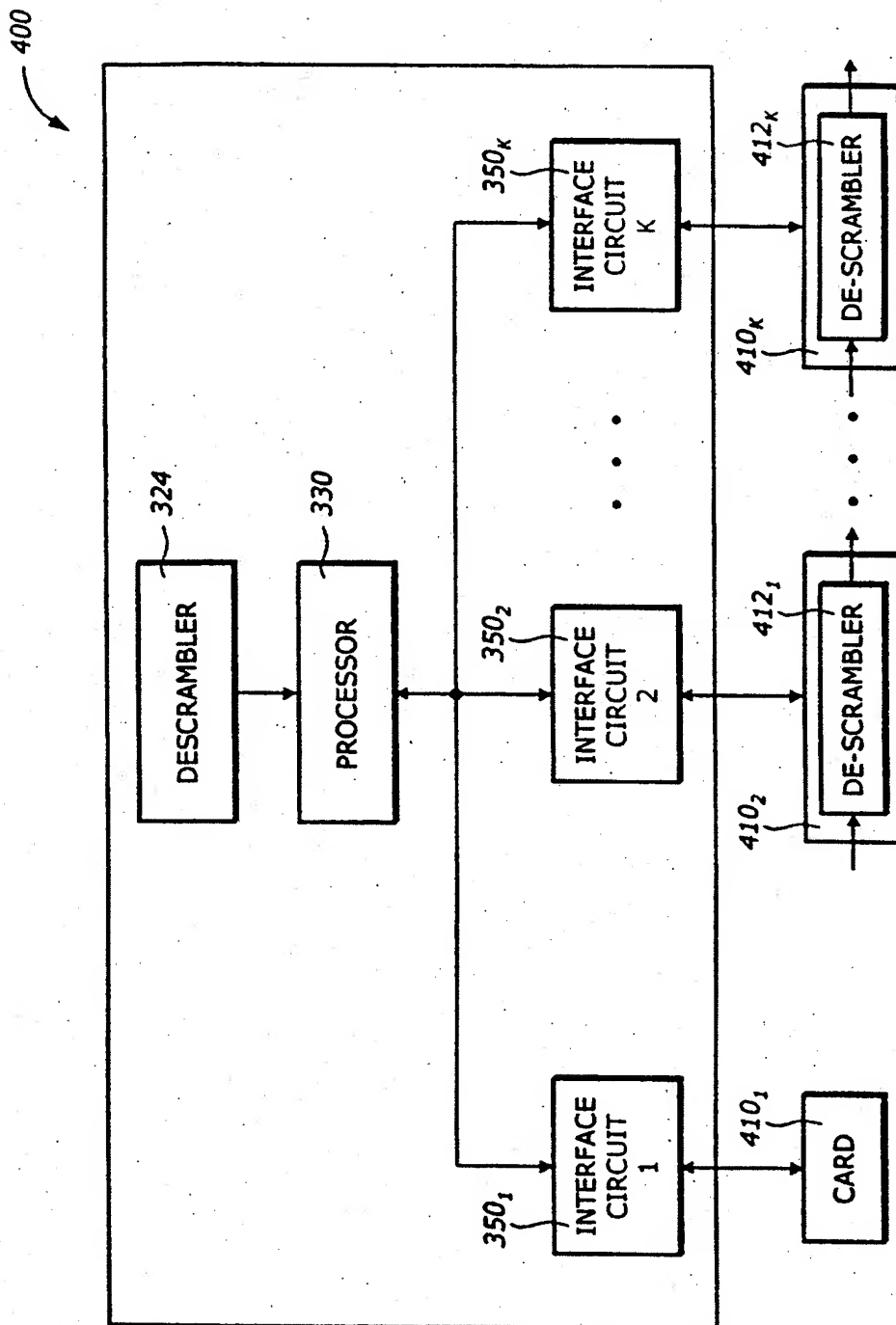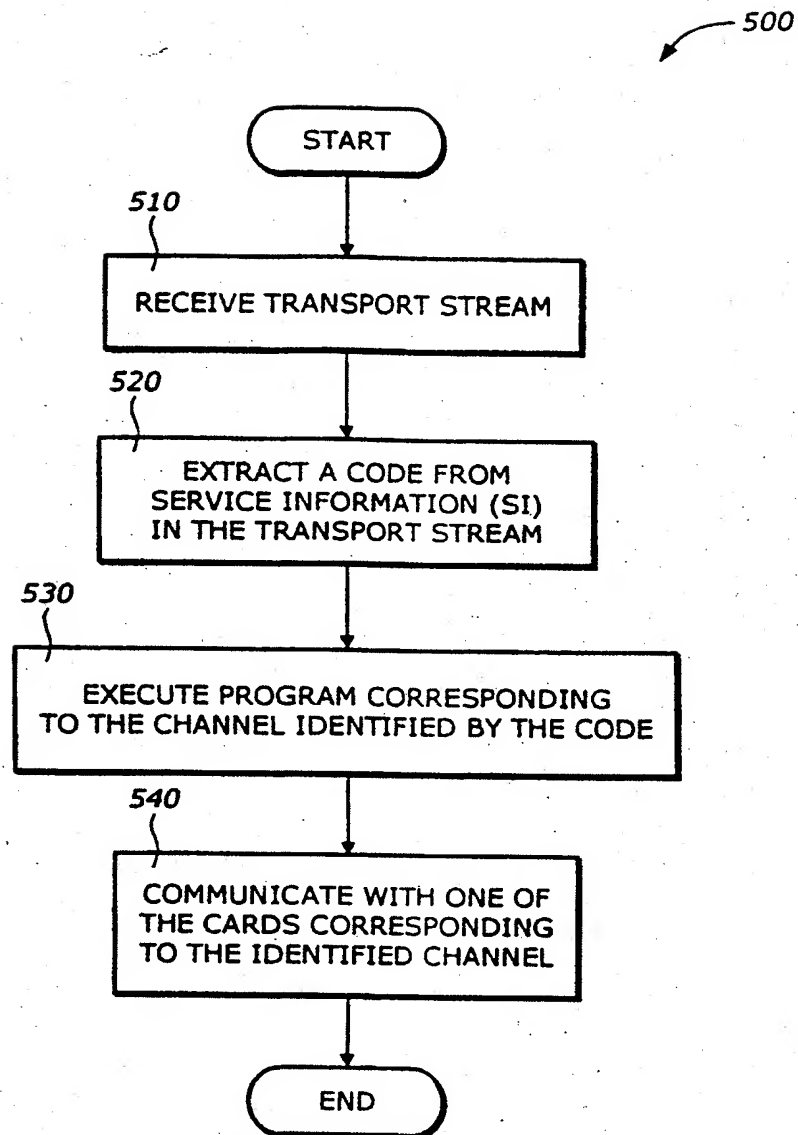
FIG. 5

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7   H04N5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7   H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 96 08912 A (HARDING MICHAEL V ;NEWBY CHARLES F (US); TITAN INFORMATION SYSTEMS) 21 March 1996 (1996-03-21) page 11, line 25 -page 13, line 11 ---	1-4, 8-12, 15-19
A	CUTTS D J: "DVB CONDITIONAL ACCESS" ELECTRONICS AND COMMUNICATION ENGINEERING JOURNAL,GB,INSTITUTION OF ELECTRICAL ENGINEERS, LONDON, vol. 9, no. 1, 1 February 1997 (1997-02-01), pages 21-27, XP000722905 ISSN: 0954-0695 the whole document ---	1-21

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[X] Further documents are listed in the continuation of box C.

[X]   Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

13 July 2000

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20/07/2000

Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2
NL – 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Marie-Julie, J-M

Form PCT/ISA/210 (second sheet) (July 1992)

International Application No

PCT/US 00/07214

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	WO 96 06504 A (CHANEY JOHN WILLIAM ;THOMSON CONSUMER ELECTRONICS (US)) 29 February 1996 (1996-02-29) page 12, line 29 -page 14, line 25 ---	1-21
A	GIACHETTI J -L ET AL: "A COMMON CONDITIONAL ACCESS INTERFACE FOR DIGITAL VIDEO BROADCASTING DECODERS" IEEE TRANSACTIONS ON CONSUMER ELECTRONICS,US,IEEE INC. NEW YORK, vol. 41, no. 3, 1 August 1995 (1995-08-01), pages 836-841, XP000539543 ISSN: 0098-3063 the whole document ---	1,8,15
P,A	EP 0 914 001 A (CANAL PLUS SA) 6 May 1999 (1999-05-06) page 4, column 5, line 29 - line 41 ---	1,8,15
P,A	EP 0 923 246 A (SONY UK LTD) 16 June 1999 (1999-06-16) page 3, column 3, line 53 -page 4, column 6, line 39 -----	1-21

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/07214

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